Geological Survey
of Canada

CURRENT RESEARCH
2002-C20

Surficial materials, central Baffin Island, Nunavut

L.A. Dredge

2002

Natural Resources Canada | Ressources naturelles Canada

Canada

103-04242/

©Her Majesty the Queen in Right of Canada, 2002
Catalogue No. M44-2002/C20E
ISBN 0-660-18740-X

Available in Canada from the
Geological Survey of Canada Bookstore website at:
http://www.nrcan.gc.ca/gsc/bookstore (Toll-free: 1-888-252-4301)

A copy of this publication is also available for reference by depository libraries across Canada through access to the Depository Services Program's website at http://dsp-psd.pwgsc.gc.ca

Price subject to change without notice

All requests for permission to reproduce this work, in whole or in part, for purposes of commercial use, resale, or redistribution shall be addressed to: Earth Sciences Sector Information Division, Room 402, 601 Booth Street, Ottawa, Ontario K1A 0E8.

Author's address

L.A. Dredge *(ldredge@nrcan.gc.ca)*
Geological Survey of Canda
601 Booth Street
Ottawa, Ontario K1A 0E8

Surficial materials, central Baffin Island, Nunavut

L.A. Dredge
Terrain Sciences Division

Dredge, L.A., 2002: Surficial materials, central Baffin Island, Nunavut; Geological Survey of Canada, Current Research 2002-C20, 6 p.

Abstract: Field mapping and till sampling between Foxe Basin and Barnes Ice Cap were completed for NTS 37 A and 37 D, and 520 samples were submitted for geochemical analysis. Large landforms in the area are bedrock-controlled, but surface deposits result mainly from the last glaciation and from postglacial marine inundation. The main materials are sand and stony silt near the coast, sandy to gravelly outwash in valleys that were proglacial meltwater conduits, and till plains. Northern till plains range from bouldery till to boulder fields, whereas those farther south are sandier rolling plains with fewer boulders.

Résumé : Des travaux de cartographie géologique et d'échantillonnage des tills ont été complétés dans le secteur s'étendant du bassin Foxe à la calotte glaciaire de Barnes (SNRC 37 A et 37 D) et 520 échantillons ont été soumis à l'analyse géochimique. Les grandes formes de terrain de la région montrent un lien de dépendance à la lithologie du substratum rocheux, mais les dépôts de surface résultent en majeure partie de la dernière glaciation et de la submersion marine postglaciaire. Les matériaux sont constitués principalement de sable et de silt à cailloux près de la côte, de dépôts d'épandage fluvioglaciaire sableux à graveleux dans les vallées qui ont servi de chenaux proglaciaires d'eau de fonte, et de plaines de till. Les plaines de till du nord se présentent sous forme de till blocailleux voire même de champs de blocs, alors que celles plus au sud, adoptent l'aspect de plaines ondulées, sont davantage sableuses et contiennent moins de blocs.

INTRODUCTION

The Central Baffin Project is a multidisciplinary effort directed towards improving the understanding of the geological evolution of the eastern Canadian Arctic, and providing information, through mapping, that will assist in sustainable land use and regional economic development. The Quaternary component was established)1) to provide maps of and to describe the nature and distribution of surface materials; (2) to reconstruct the glacial history of the area, including the record of postglacial sea-level change; and (3) to determine regional geochemical signatures of tills in order to establish typical background concentrations of selected elements, for use in exploration geology and environmental assessments. In addition, special emphasis has been concentrated on recent retreat rates of the Barnes Ice Cap and its significance for assessing climate change in the eastern Arctic. A related project component (Zdanowicz et al., 2002) involves reactivation of studies of the Barnes Ice Cap. The entire project area includes four 1:250 000 map sheets extending from west central Baffin to the eastern highlands (Fig. 1). The map scale for field work is 1:60 000, although final map compilations will be made at smaller scales.

PREVIOUS WORK AND QUATERNARY COMPONENT FOR 2001

This progress report summarizes the general character of surface materials in NTS sheets 37 A and 37 D, the region covered during the summer of 2001 (Fig. 2). The map area extends from the flat nearshore islands in Foxe Basin, inland across the lowlands of west central Baffin, to the upland plateau along the margin of the Barnes Ice Cap. It covers an area of about 37 000 km². The area had been previously mapped at a scale of 1:500 000 by Sim (1964) as part of Geographical Branch efforts in the 1960s. Most of this work was accomplished by airphoto interpretation, with only limited ground work. In addition, King and Buckley (1967), Andrews (1970), and Dredge (1999) undertook more detailed field work and provided maps or interpretations of glacial history for Gillian Lake and Flint Lake. Also, Loken and Andrews (1966) have measured lichen sizes on several moraines west of Flyway Lake in order to determine their age. The first systematic mapping of the area that is based on extensive ground traverses was begun in 2001.

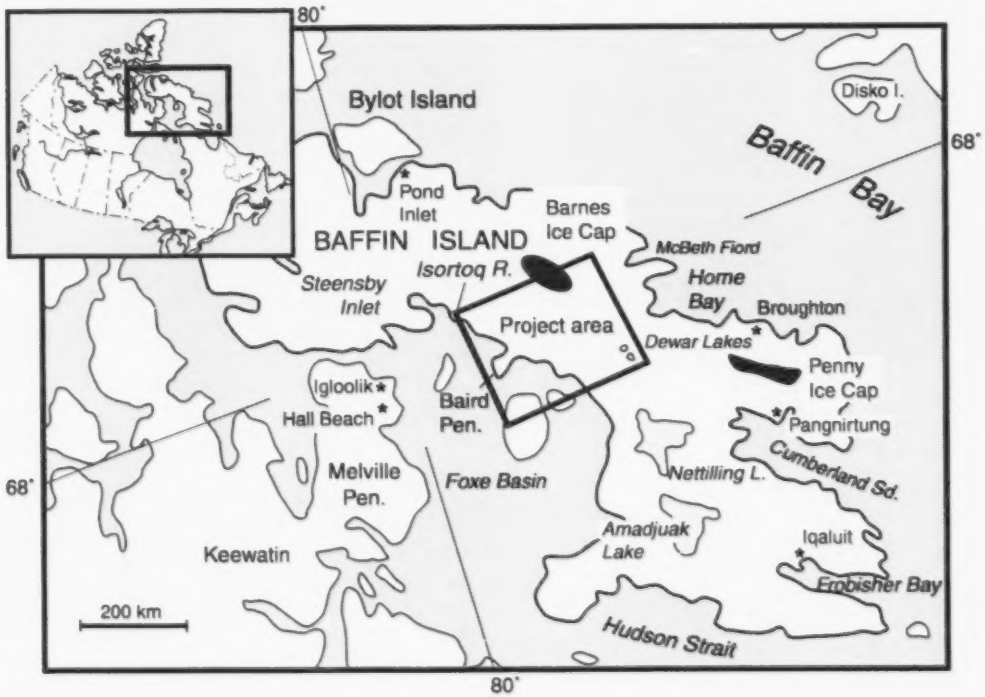

Figure 1. *Location of the project area.*

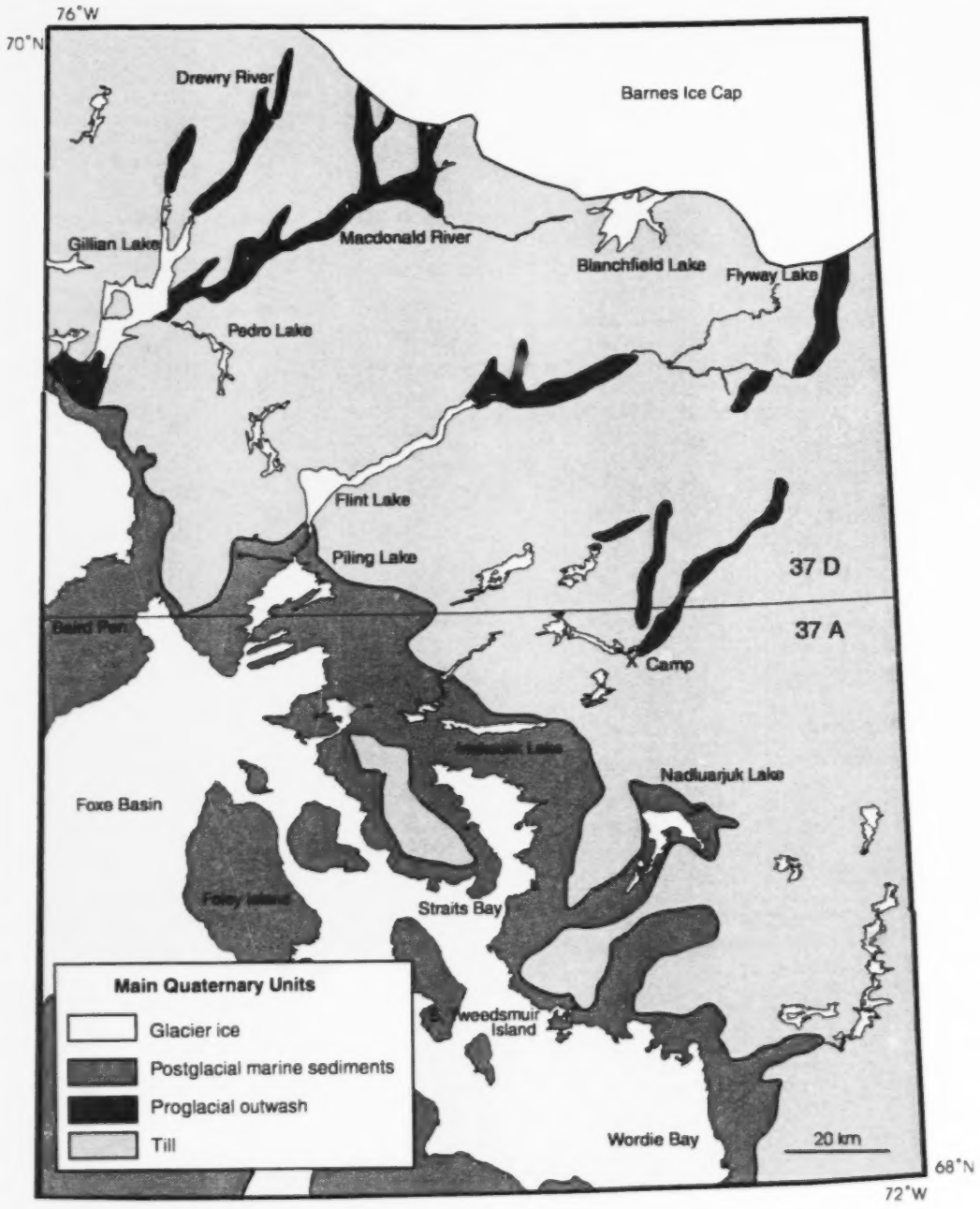

Figure 2. *Areas mapped in 2001 and distribution of Quaternary deposit types.*

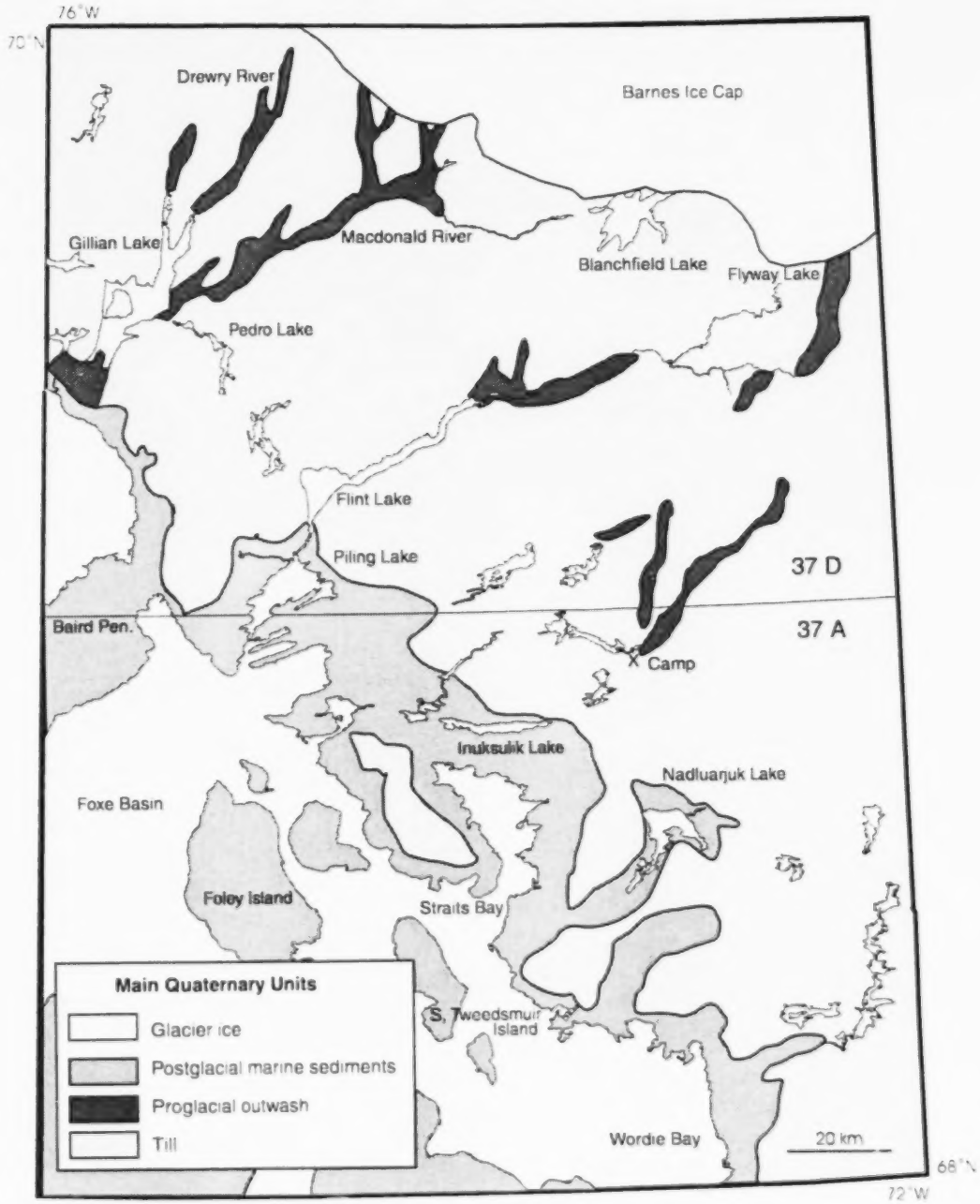

Figure 2. *Areas mapped in 2001 and distribution of Quaternary deposit types.*

SURFACE MATERIALS

Postglacial marine deposits

The nearshore islands and Baird Peninsula, which are underlain by Paleozoic limestone and dolostone, form low, grassy plains consisting primarily of stony silt or fine sand. Raised beaches formed of broken plates of dolostone create most of the topographic relief (Fig. 3). Although raised marine deposits of postglacial age mantle most of the bedrock, there are a few limestone buttes and areas of granitic bedrock protruding through the Quaternary cover, for example, on South Tweedsmuir Island near Straits Bay.

North of Flint Lake, the Foxe lowlands form a narrow band of terrain that is strictly limited by an escarpment trending parallel to the coast and situated 1 to 4 km inland. The lowland is dominated by sand and cobble beach ridges that extend from sea level at the coast to an elevation of 110 m. Marine shells are scarce, but some have been recovered from raised deltas.

Figure 3. *Raised beaches at Anderson Bluff on Foley Island, shown in the foreground. The darker tone in the background is a grassy plain that lies only a few metres above sea level.*

Figure 4. *Grassy lowland plains with shallow tundra ponds surround Piling Lake and provide prime wildlife habitat.*

Extensive grassy lowland plains with shallow tundra ponds surround Piling Lake and extend south to Wordie Bay and inland for 30 km at Nadluarjuk (Radar) Lake (Fig. 4). These provide prime wetland habitat for birds and mammals. Most wetlands are underlain by deposits consisting of stony silt and sand; raised gravel beaches, sandy deltas, till patches, and bedrock knobs are the main landforms in well drained areas. Marine deposits cover till and bedrock up to an elevation of more than 110 m near the coast, but only up to about 60 m at their farthest inland extent.

Till

Rocky uplands and rolling till plains extend inland from and rise above the coastal lowlands. Till is the main surface material over much of the region, although the area of till shown in Figure 2 also contains significant areas of rock outcrop . Both till and associated bedrock landforms appear to have been generated by ice that flowed westward from the central plateau of Baffin Island towards Foxe Basin, although limited evidence also exists of another ice flow from an ice dome centred in the area now occupied by Foxe Basin.

The character of the till is directly related to rock types and ice dynamics, although the latter effects are not discussed in this report. Proterozoic and Archean granite and gneiss are the main rock types north of Flint Lake and east of Wordie Bay (Corrigan et al., 2001; St-Onge et al., 2001). Till derived from these rock types is sandy to bouldery, and extensive bouldery till plains characterize much of the northern landscape. Boulder fields lacking sandy or granular matrix material are prevalent north and east of Gillian Lake (Fig. 5). Mudboils are scarce due to a shortage of fine-grained matrix material, reflecting either the immature nature of the till or the winnowing of fine particles by glacial meltwater. Other areas underlain by granitic and gneissic rock farther south, however, are covered with rolling till plains with abundant mudboils, in which the till has a low to moderate boulder content and the matrix is a well graded silty sand.

Figure 5. *A boulder field 20 km northeast of Gillian Lake dominates the foreground. Bouldery till plains are visible in the distance.*

Between Flint Lake and Wordie Bay, the landscape is dominated by a series of east-west-trending ridges and valleys, created by folds and other structural elements in the Proterozoic metasedimentary rocks of the Piling Group, especially the Longstaff Bluff Formation (St-Onge et al., 2001). The topography has been enhanced, however, by glaciers that have selectively eroded weaker rock layers. Although bedrock forms the valley walls, till veneers and blankets up to 8 m thick cover much of this terrain (Fig. 6). The till is well graded and has a silty sand matrix and a boulder content that is generally lower than areas farther north. In NTS 37 A, the highest boulder contents on till overlying rocks of the Piling Group are in the northeast part of the map sheet, nearest old glacier divides and centres of thin, late ice caps.

Figure 6. *Rolling till plains with mudboils and a scattering of boulders form terrain inland from Nadluarjuk Lake. Outcrops of Longstaff Bluff Formation protrude through the till in the distance.*

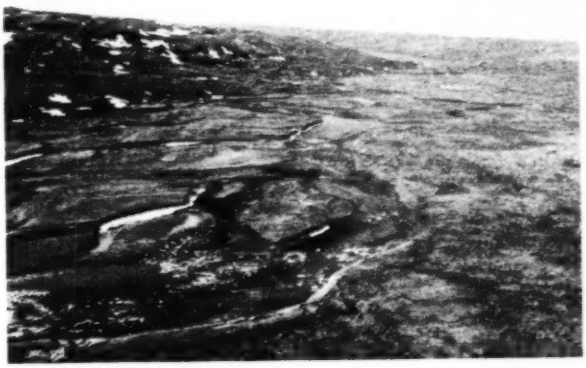

Figure 7. *Terraced outwash gravels occupy the Drewry River valley. The modern braidplain, at river level, results from seasonally varying meltwater flow from the Barnes Ice Cap.*

Figure 8. *Glacial meltwater flows along, and in front of, the margin of the Barnes Ice Cap. Shown here is the source region for the south branch of the MacDonald River.*

Inland from Wordie Bay, the till has a higher silt component than in other parts of the map area, and a slightly calcareous matrix as a result of inclusion of limestone particles.

Outwash

Sandy outwash deposits are prevalent along the sides and bottoms of the main river valleys, particularly those of the Drewry (Fig. 7) and MacDonald rivers, and those draining into or out of Gillian, Flint, and Flyway lakes. Terraces and raised deltas are the products of late-glacial meltwater deposition associated with glaciers that receded inland towards the central Baffin plateau. Extensive outwash sand and gravel along valley bottoms are the product of active transport and deposition of material from the Barnes Ice Cap (Fig. 8). The modern outwash plains and related floodplains have braided channel patterns.

Glacial lake sediments

Ice-contact glacial lake deposits probably underlie parts of Gillian and Flint lakes. Thinner blankets of sand and silt and small sublacustrine moraines are common within 20 km of the Barnes Ice Cap in the area mapped during the summer of 2001, but cover areas too small to be portrayed on a regional scale. More extensive deposits are found around Generator Lake, in NTS area 27 C.

ACKNOWLEDGMENTS

This project was made possible through closely co-ordinated work with the Continental Geoscience Division of the Geological Survey, the Canada-Nunavut Geoscience Office, and the Polar Continental Shelf Project. I would like to thank all participants for their enthusiasm and help, in particular the students of the Q-team: Becky Chouinard, Jordan-Gus-George Severin, and Trish Toole.

REFERENCES

Andrews, J.T.
1970: Differential crustal recovery and glacial chronology, west Baffin Island, NWT. Arctic and Alpine Research, v. 2, p. 115–134.

Corrigan, D., Scott, D.J., and St-Onge, M.R.
2001: Geology of the northern margin of the Trans-Hudson Orogen (Foxe Fold Belt, central Baffin Island, Nunavut; Geological Survey of Canada, Current Research 2001-C23, 17 p.

Dredge, L.A.
1999: Glacial dispersal patterns and postglacial marine overlap in the Longstaff Bluff area, central Baffin Island; *in* Current Research 1999-1C; Geological Survey of Canada, p. 1–8.

King, C.A.M. and Buckley, J.T.
1967: The chronology of deglaciation around Eqe Bay and Lake Gillian, Baffin Island; Geographical Bulletin, v. 19, p. 20–32.

Loken, O.H. and Andrews, J.T.
1966: Glaciology and chronology of fluctuations of the ice margin at the south end of the Barnes Ice Cap, Baffin Island; Geographical Bulletin, v. 8, no. 4, p. 341–359.

Sim, V.W.
1964: Terrain analysis of west-central Baffin Island; Geographical Bulletin, v. 21, p. 66–92.

St-Onge, M.R., Corrigan, D., and Scott, D.J.
2001: Geology, Piling Lake, Nunavut; Geological Survey of Canada, Open File 4003, scale 1:250 000.

Zdanowicz, C., Fisher, D., Clark, I., and Lacelle, D.
2002: Ice-marginal studies on Barnes Ice Cap, Baffin Island: implications for the history of the Laurentide Ice Sheet; Geological Survey of Canada, Current Research 2002-C21.

Geological Survey of Canada Project 1006LD